Teaching Contemporary O&P Techniques in Bolivia . . . Including a Remarkable Toyota Landcruiser Vacuum-Form Method

by John Michael, CPO

At the invitation of Bolivian prosthetists and orthotists, I recently spent two weeks in the Andes mountains helping to enhance the quality of prosthetic-orthotic care there. I made my trip on behalf of the American Academy of Orthotists and Prosthetists and Duke University Medical Center with funding provided by the Agency for International Development, Partners of the Americas, and Partner's Appropriate Technology for the Handicapped (PATH).

My journey to Bolivia followed-up a visit to the United States last year by Bolivian prosthetist Carlos Guaman. While in North Carolina, Guaman spent several weeks studying orthotic and prosthotic techniques at Duke University and with private practitioners Carl Tyndall, CPO, of Greenville and Robert Weaver, CP, of Raleigh. During my trip, I assisted the Bolivians in implementing and proliferating the fabrication and fitting techniques taught to Guaman during his stay in the United States.

While in Bolivia, I worked at Tierra de Hombres Children's Hospital in Cochabamba, the country's third largest city. Although the hospital is severely limited due to a lack of funds and sparse local resources, its conscientious staff combines ingenuity, skill, and plain old hard work to create useful, functional prosthetic and orthotic devices.

For example, HKAFO components are laboriously hacksawed from scrap aluminum and steel, recycled from aircraft wreckage found in the rugged mountain peaks. External keel SACH feet are hand cut from local trees, bonded to shoe soling rubber, reinforced with auto tire remnants, and covered with cowhide. Bicycle components combined with ingenuity and steel tubing create a very rugged, reliable "mountain wheelchair" which withstands the rocky terrain much better than imported versions.

As part of my program, I presented a two-day slide/video seminar on modern orthotic and prosthetic practices. The seminar was attended by every known prosthetist and orthotist in the country as well as numerous physicians, therapists, and other allied health personnel. One participant, whose sole source of mobility is a wheelchair, traveled more than 14 hours by bus through the mountains to attend the program.

A three year old Bolivian girl ambulated with tripod crutches and bilateral above-knee prostheses.

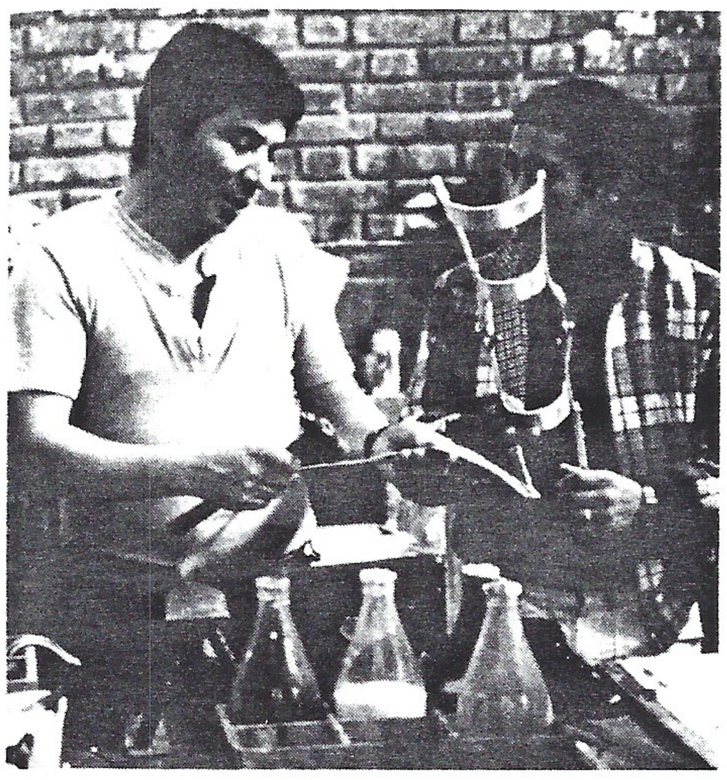
Through Spanish translators, all of Bolivia's orthotic and prosthetic personnel joined me in animated discussions of specific cases, principles, and designs. The probing questions and outpouring of enthusiasm were indicative of a high degree of Bolivian interest in further knowledge in this area. To allow more detailed review at a later date I donated my slides and video to the hospital's library.

A clinical workshop followed the classroom program. In addition to examination and evaluation of children already fitted, several new fittings using more sophisticated techniques were completed. The emphasis was on adapting contemporary techniques to local conditions, making sure the results are practical and useful.

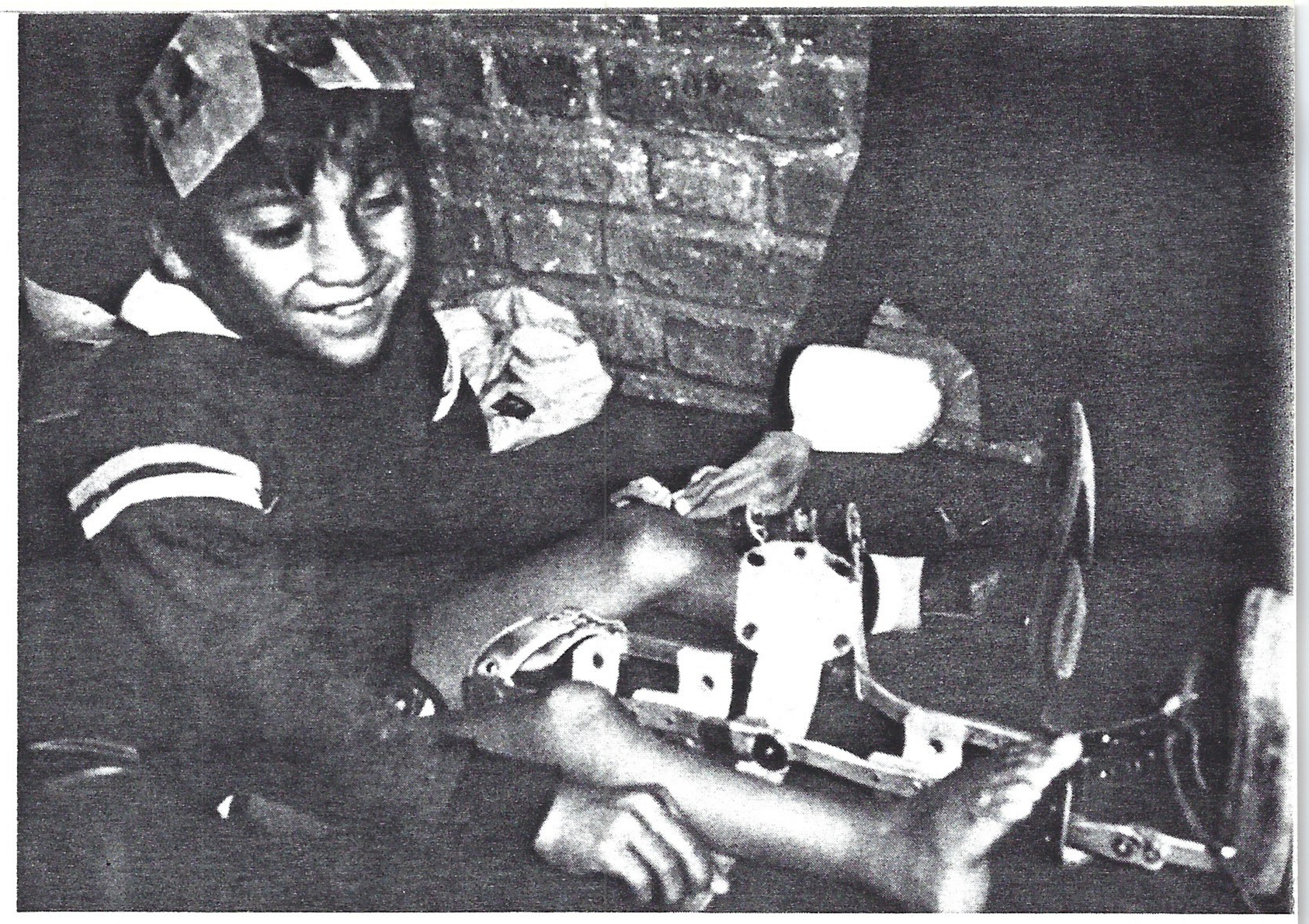
As you might expect in an underdeveloped country like Bolivia, it takes more than just knowledge of a technique to fabricate and fit an orthotic or prosthetic device. Practitioners there are forced to apply contemporary techniques using either antique or makeshift equipment. For example, utilizing a dilapidated propane oven, plus a length of garden hose and vacuum assist from the brake system of a Toyota Landcruiser, we—for the first time ever in Cochabamba—fabricated polypropylene orthoses. Prior to our achievement, the only method for making plastic braces involved laboriously hacksawing PVC sewer pipe into segments to obtain the raw materials. The finished orthoses were much heavier and much more rigid than necessary.

Suprisingly, the quality of the orthotic-prosthetic practitioner in Bolivia is quite good, although the number of practitioners is very small. There are only about a dozen practitioners in the country. Most receive their basic training in Brazil or Argentina, countries larger and much more developed than Bolivia. The training there is contemporary by U.S. standards, including fabrication with polypropylene and polyethylene. But the programs are conducted more at a technician level than practitioner level because of the conditions practitioners must cope with in Bolivia.

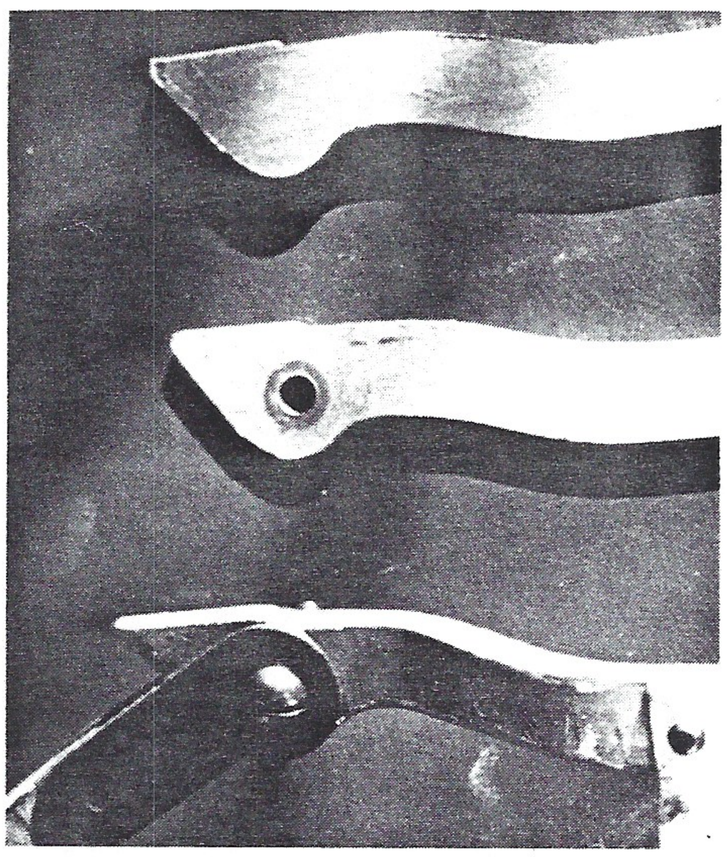
The most common causes of orthopedic impairment in this South American country are deformities, polio, tuberculosis, and trauma. The



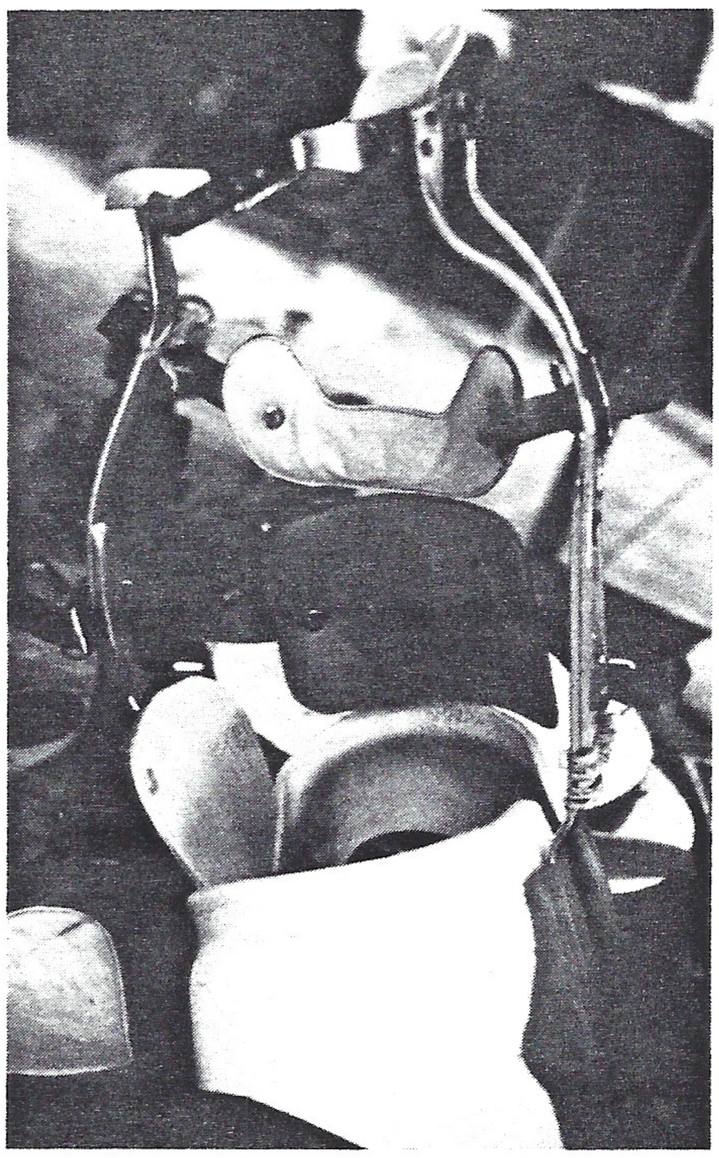
Bolivian orthotists discuss KAFO construction.



KAFO with a shoe raise for a young polio patient (Also, homemade sunglasses fashioned from corregated cardboard and plastizine.)

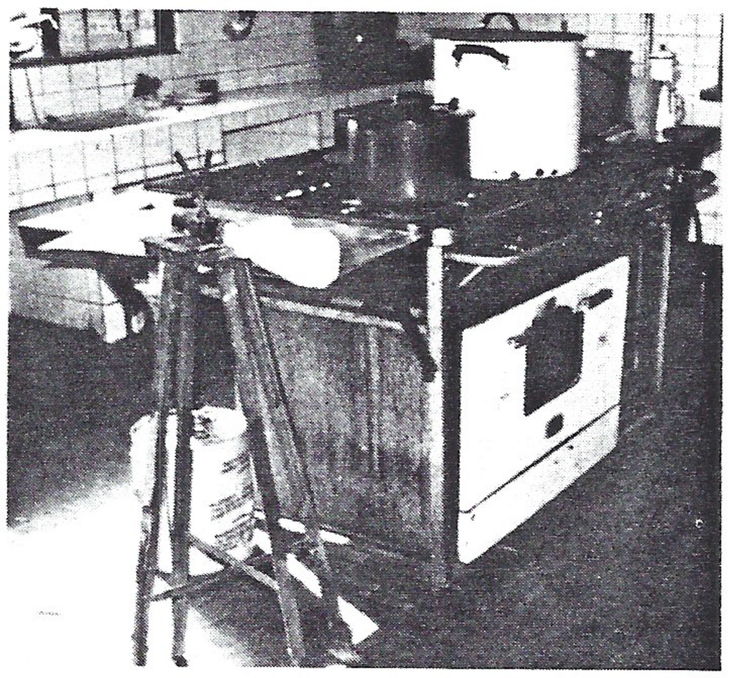


Aluminum from aircraft wreckage is hand sawn, fitted with local brass bushings, and assembled into orthotic joints.



A Milwaukee brace with plastic pelvic section fabricated from twelve inch sewer pipe.

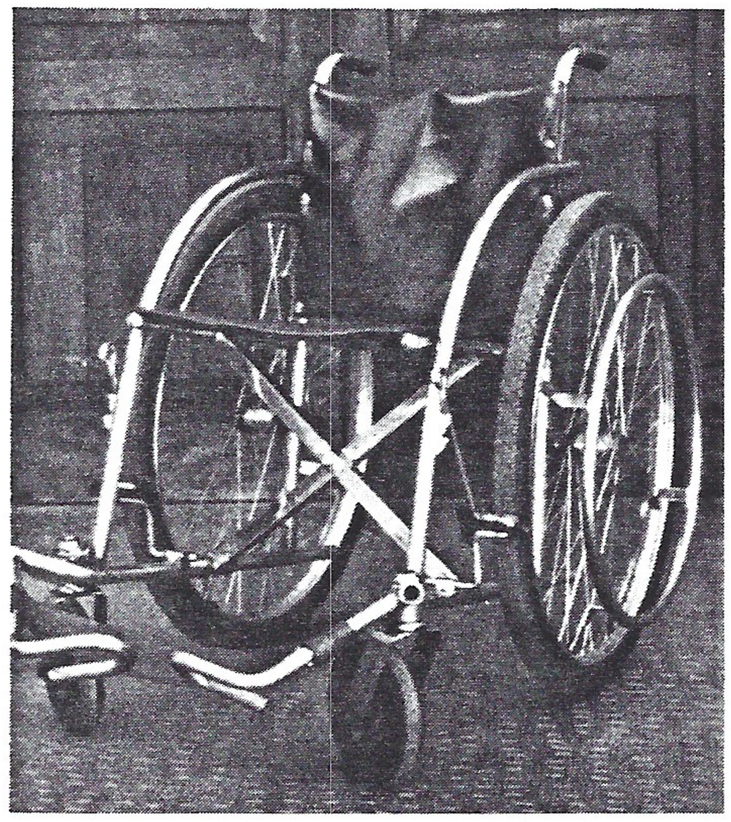
Attaching garden hose to a Toyota Landcruiser as a vacuum source.



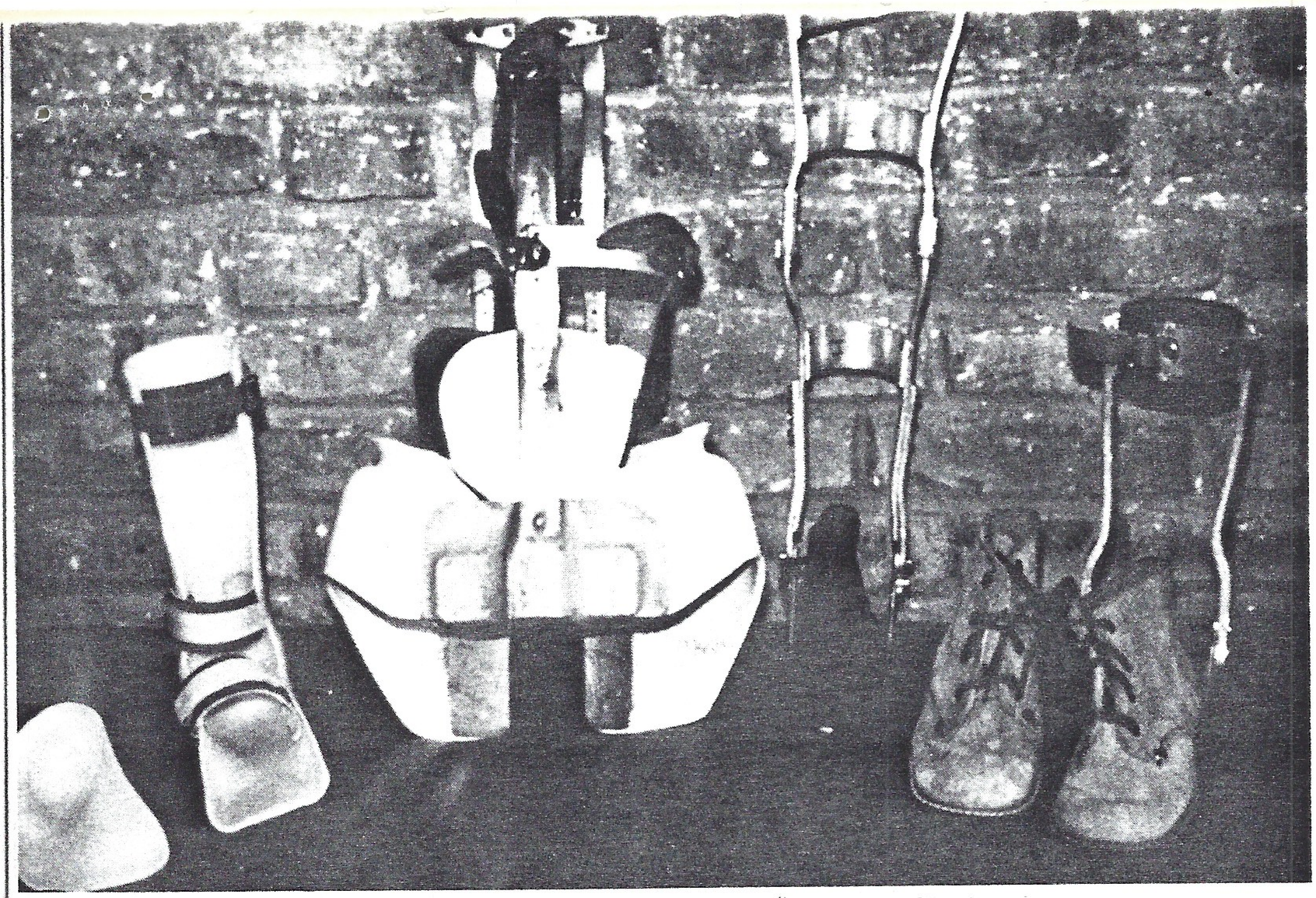
Dilapidated propane-fired stove used for plastic fabrication.

per capita incidence for each is several times greater in Bolivia than it is in the United States. Hygiene and sanitation problems are largely responsible for the high rate of disease, while an alarming number of automobile accidents is the leading cause of traumatic injury.

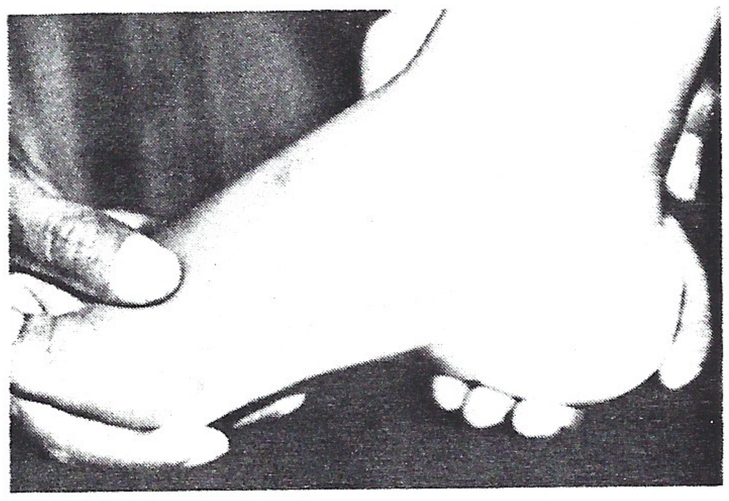
In Cochabamba, except for the six blocks immediately at the town



Rugged mountain wheelchair made from bicycle parts and steel tubing.



Bolivian orthotists can fabricate a broad range of devices using simple tools and local materials.



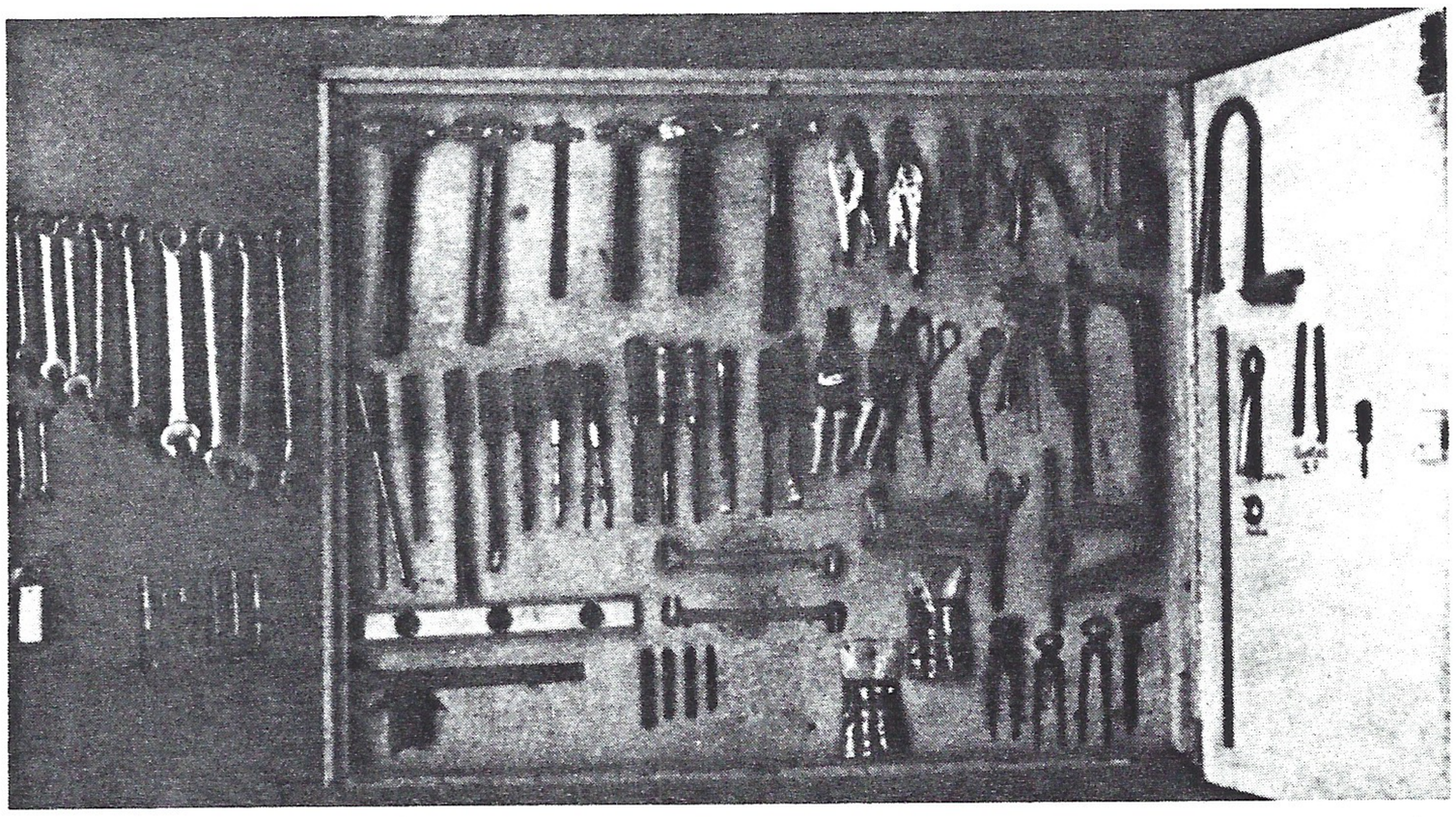
Fitting the first molded plastic VCB fabricated at Tierra de Hombres.

square, there are no traffic lights, no traffic signs, and apparently no traffic laws. The custom is, whoever toots his horn first has the right of way. With pedestrians, bicycles, ox carts, buses, and automobiles all sharing the same road and colliding at intersections, the accidents are frightening. The number of amputations is substantial.

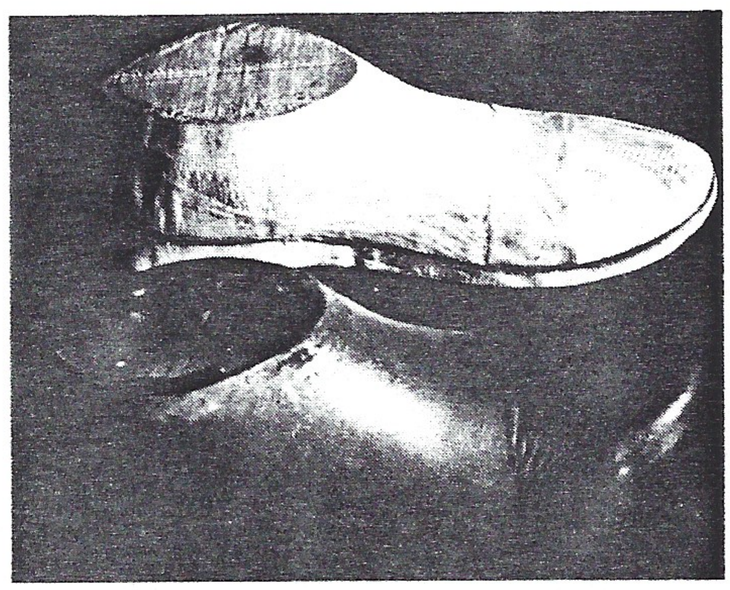
From what I have seen, the quality of amputation surgery in Bolivia is quite good. The problems are with surgery for other conditions. Doctors do not have the capability for many advanced surgeries and accessibility to surgery is limited. Here hospitals cannot do severe scoliosis surgical corrections and many of the spinal procedures that we take for granted. Unfortunately, there is also a very high infection and complication rate because of the poor sanitation at the hospitals available to the poor.

Throughout the country orthotic and prosthetic care facilities are sparse. Such facilities have only existed in the country for about 12 years. If I were to characterize a typical facility in Bolivia, it would be a small institutional practice with two or three practitioners, subsidized largely by either a religious organization, a foreign service organization, or a philanthropic organization that's indigenous. There really is no typical facility in the country and the number of private practitioners is very small because of the lack of funding and insurance.

Despite the severe limitations in funding and materials, the dedication, ingenuity, and attitude of our Bolivian colleagues is inspiring. They are confronting their challenge and doing an impressive job at providing effective prosthetic and orthotic care. They do, however, need our help. International collaborations such as the Bolivia project provide invaluable assistance in furthering the skills and options of less developed countries. Adapting our technologies to local conditions as we did during my efforts helps to keep the costs low enough to permit widespread dissemination and application of much needed care.



Simple hand tools used for fabrication in Bolivia.



Indigenous SACH foot composed of local materials and covered with leather.

I urge my American colleagues to help our counterparts in Bolivia and other countries. If you wish to donate materials or participate in a program please contact: PATH/Americas, 2001 "S" Street, N.W., Washington, DC, 20009; (202) 332-7332.